SEQUENCE LISTING

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<120> Alpha-Amulase Mutants

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<160> 58

<170> FastSEQ for Windows Version 3.0

<210> 1
<211> 485
<212> PRT
<213> Bacillus

<400> 1

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 1               5                  10                  15
Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Arg Asp Asp Ala Ala
            20                  25                  30
Asn Leu Lys Ser Lys Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Trp
        35                  40                  45
Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
    50                  55                  60
Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
65                  70                  75                  80
Thr Arg Asn Gln Leu Gln Ala Ala Val Thr Ser Leu Lys Asn Asn Gly
                85                  90                  95
Ile Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
            100                 105                 110
Gly Thr Glu Ile Val Asn Ala Val Glu Val Asn Arg Ser Asn Arg Asn
        115                 120                 125
Gln Glu Thr Ser Gly Glu Tyr Ala Ile Glu Ala Trp Thr Lys Phe Asp
    130                 135                 140
Phe Pro Gly Arg Gly Asn Asn His Ser Ser Phe Lys Trp Arg Trp Tyr
145                 150                 155                 160
His Phe Asp Gly Thr Asp Trp Asp Gln Ser Arg Gln Leu Gln Asn Lys
                165                 170                 175
```

```
Ile Tyr Lys Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Asp
            180                 185                 190
Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Met
        195                 200                 205
```

```
Asp His Pro Glu Val Ile His Glu Leu Arg Asn Trp Gly Val Trp Tyr
    210                 215                 220
Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
225                 230                 235                 240
Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Thr
                245                 250                 255
Thr Gly Lys Pro Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
            260                 265                 270
Gly Ala Ile Glu Asn Tyr Leu Asn Lys Thr Ser Trp Asn His Ser Val
        275                 280                 285
Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly
    290                 295                 300
Gly Tyr Tyr Asp Met Arg Asn Ile Leu Asn Gly Ser Val Val Gln Lys
305                 310                 315                 320
His Pro Thr His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
                325                 330                 335
Gly Glu Ala Leu Glu Ser Phe Val Gln Gln Trp Phe Lys Pro Leu Ala
            340                 345                 350
Tyr Ala Leu Val Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
        355                 360                 365
Gly Asp Tyr Tyr Gly Ile Pro Thr His Gly Val Pro Ala Met Lys Ser
    370                 375                 380
Lys Ile Asp Pro Leu Leu Gln Ala Arg Gln Thr Phe Ala Tyr Gly Thr
385                 390                 395                 400
Gln His Asp Tyr Phe Asp His His Asp Ile Ile Gly Trp Thr Arg Glu
                405                 410                 415
Gly Asn Ser Ser His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
            420                 425                 430
Gly Pro Gly Gly Asn Lys Trp Met Tyr Val Gly Lys Asn Lys Ala Gly
        435                 440                 445
Gln Val Trp Arg Asp Ile Thr Gly Asn Arg Thr Gly Thr Val Thr Ile
    450                 455                 460
Asn Ala Asp Gly Trp Gly Asn Phe Ser Val Asn Gly Gly Ser Val Ser
465                 470                 475                 480
Val Trp Val Lys Gln
                485
```

<210> 2
<211> 485
<212> PRT
<213> Bacillus sp.

<400> 2

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His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp His
 1               5                  10                  15
Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Arg Asp Asp Ala Ser
            20                  25                  30
Asn Leu Arg Asn Arg Gly Ile Thr Ala Ile Trp Ile Pro Pro Ala Trp
        35                  40                  45
Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
    50                  55                  60
Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
65                  70                  75                  80
Thr Arg Ser Gln Leu Glu Ser Ala Ile His Ala Leu Lys Asn Asn Gly
                85                  90                  95
Val Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
            100                 105                 110
Ala Thr Glu Asn Val Leu Ala Val Glu Val Asn Pro Asn Asn Arg Asn
        115                 120                 125
Gln Glu Ile Ser Gly Asp Tyr Thr Ile Glu Ala Trp Thr Lys Phe Asp
    130                 135                 140
Phe Pro Gly Arg Gly Asn Thr Tyr Ser Asp Phe Lys Trp Arg Trp Tyr
```

```
145                 150                 155                 160
His Phe Asp Gly Val Asp Trp Asp Gln Ser Arg Gln Phe Gln Asn Arg
                165                 170                 175
Ile Tyr Lys Phe Arg Gly Asp Gly Lys Ala Trp Asp Trp Glu Val Asp
            180                 185                 190
Ser Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Met
        195                 200                 205
Asp His Pro Glu Val Val Asn Glu Leu Arg Arg Trp Gly Glu Trp Tyr
    210                 215                 220
Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
225                 230                 235                 240
Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Ala
                245                 250                 255
Thr Gly Lys Glu Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
            260                 265                 270
Gly Ala Leu Glu Asn Tyr Leu Asn Lys Thr Asn Trp Asn His Ser Val
        275                 280                 285
Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly
    290                 295                 300
Gly Asn Tyr Asp Met Ala Lys Leu Leu Asn Gly Thr Val Val Gln Lys
305                 310                 315                 320
His Pro Met His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
                325                 330                 335
Gly Glu Ser Leu Glu Ser Phe Val Gln Glu Trp Phe Lys Pro Leu Ala
            340                 345                 350
Tyr Ala Leu Ile Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
        355                 360                 365
Gly Asp Tyr Tyr Gly Ile Pro Thr His Ser Val Pro Ala Met Lys Ala
    370                 375                 380
Lys Ile Asp Pro Ile Leu Glu Ala Arg Gln Asn Phe Ala Tyr Gly Thr
385                 390                 395                 400
Gln His Asp Tyr Phe Asp His His Asn Ile Ile Gly Trp Thr Arg Glu
                405                 410                 415
Gly Asn Thr Thr His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
            420                 425                 430
Gly Pro Gly Gly Glu Lys Trp Met Tyr Val Gly Gln Asn Lys Ala Gly
        435                 440                 445
Gln Val Trp His Asp Ile Thr Gly Asn Lys Pro Gly Thr Val Thr Ile
    450                 455                 460
Asn Ala Asp Gly Trp Ala Asn Phe Ser Val Asn Gly Gly Ser Val Ser
465                 470                 475                 480
Ile Trp Val Lys Arg
                485
```

<210> 3
<211> 514
<212> PRT
<213> Bacillus stearothermophilus

<400> 3

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Ala Ala Pro Phe Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr Leu
 1               5                  10                  15
Pro Asp Asp Gly Thr Leu Trp Thr Lys Val Ala Asn Glu Ala Asn Asn
            20                  25                  30
Leu Ser Ser Leu Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys
        35                  40                  45
Gly Thr Ser Arg Ser Asp Val Gly Tyr Gly Val Tyr Asp Leu Tyr Asp
    50                  55                  60
Leu Gly Glu Phe Asn Gln Lys Gly Ala Val Arg Thr Lys Tyr Gly Thr
65                  70                  75                  80
Lys Ala Gln Tyr Leu Gln Ala Ile Gln Ala Ala His Ala Ala Gly Met
                85                  90                  95
```

```
Gln Val Tyr Ala Asp Val Val Phe Asp His Lys Gly Gly Ala Asp Gly
            100                 105                 110
Thr Glu Trp Val Asp Ala Val Glu Val Asn Pro Ser Asp Arg Asn Gln
        115                 120                 125
Glu Ile Ser Gly Thr Tyr Gln Ile Gln Ala Trp Thr Lys Phe Asp Phe
    130                 135                 140
Pro Gly Arg Gly Asn Thr Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His
145                 150                 155                 160
Phe Asp Gly Val Asp Trp Asp Glu Ser Arg Lys Leu Ser Arg Ile Tyr
                165                 170                 175
Lys Phe Arg Gly Ile Gly Lys Ala Trp Asp Trp Glu Val Asp Thr Glu
            180                 185                 190
Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp His
        195                 200                 205
Pro Glu Val Val Thr Glu Leu Lys Ser Trp Gly Lys Trp Tyr Val Asn
    210                 215                 220
Thr Thr Asn Ile Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys
225                 230                 235                 240
Phe Ser Phe Phe Pro Asp Trp Leu Ser Asp Val Arg Ser Gln Thr Gly
                245                 250                 255
Lys Pro Leu Phe Thr Val Gly Glu Tyr Trp Ser Tyr Asp Ile Asn Lys
            260                 265                 270
Leu His Asn Tyr Ile Met Lys Thr Asn Gly Thr Met Ser Leu Phe Asp
        275                 280                 285
Ala Pro Leu His Asn Lys Phe Tyr Thr Ala Ser Lys Ser Gly Gly Thr
    290                 295                 300
Phe Asp Met Arg Thr Leu Met Thr Asn Thr Leu Met Lys Asp Gln Pro
305                 310                 315                 320
Thr Leu Ala Val Thr Phe Val Asp Asn His Asp Thr Glu Pro Gly Gln
                325                 330                 335
Ala Leu Gln Ser Trp Val Asp Pro Trp Phe Lys Pro Leu Ala Tyr Ala
            340                 345                 350
Phe Ile Leu Thr Arg Gln Glu Gly Tyr Pro Cys Val Phe Tyr Gly Asp
        355                 360                 365
Tyr Tyr Gly Ile Pro Gln Tyr Asn Ile Pro Ser Leu Lys Ser Lys Ile
    370                 375                 380
Asp Pro Leu Leu Ile Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln His
385                 390                 395                 400
Asp Tyr Leu Asp His Ser Asp Ile Ile Gly Trp Thr Arg Glu Gly Val
                405                 410                 415
Thr Glu Lys Pro Gly Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro
            420                 425                 430
Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Gln His Ala Gly Lys Val
        435                 440                 445
Phe Tyr Asp Leu Thr Gly Asn Arg Ser Asp Thr Val Thr Ile Asn Ser
    450                 455                 460
Asp Gly Trp Gly Glu Phe Lys Val Asn Gly Gly Ser Val Ser Val Trp
465                 470                 475                 480
Val Pro Arg Lys Thr Thr Val Ser Thr Ile Ala Trp Ser Ile Thr Thr
                485                 490                 495
Arg Pro Trp Thr Asp Glu Phe Val Arg Trp Thr Glu Pro Arg Leu Val
            500                 505                 510
Ala Trp
```

<210> 4
<211> 483
<212> PRT
<213> Bacillus licheniformis

<400> 4

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Ala Asn Leu Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Met Pro
```

```
 1               5                  10                  15
Asn Asp Gly Gln His Trp Arg Arg Leu Gln Asn Asp Ser Ala Tyr Leu
            20                  25                  30
Ala Glu His Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly
        35                  40                  45
Thr Ser Gln Ala Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr Asp Leu
    50                  55                  60
Gly Glu Phe His Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys
65                  70                  75                  80
Gly Glu Leu Gln Ser Ala Ile Lys Ser Leu His Ser Arg Asp Ile Asn
                85                  90                  95
Val Tyr Gly Asp Val Val Ile Asn His Lys Gly Gly Ala Asp Ala Thr
            100                 105                 110
Glu Asp Val Thr Ala Val Glu Val Asp Pro Ala Asp Arg Asn Arg Val
        115                 120                 125
Ile Ser Gly Glu His Leu Ile Lys Ala Trp Thr His Phe His Phe Pro
    130                 135                 140
Gly Arg Gly Ser Thr Tyr Ser Asp Phe Lys Trp His Trp Tyr His Phe
145                 150                 155                 160
Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn Arg Ile Tyr Lys
                165                 170                 175
Phe Gln Gly Lys Ala Trp Asp Trp Glu Val Ser Asn Glu Asn Gly Asn
            180                 185                 190
Tyr Asp Tyr Leu Met Tyr Ala Asp Ile Asp Tyr Asp His Pro Asp Val
        195                 200                 205
Ala Ala Glu Ile Lys Arg Trp Gly Thr Trp Tyr Ala Asn Glu Leu Gln
    210                 215                 220
Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Phe Ser Phe
225                 230                 235                 240
Leu Arg Asp Trp Val Asn His Val Arg Glu Lys Thr Gly Lys Glu Met
                245                 250                 255
Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Leu Gly Ala Leu Glu Asn
            260                 265                 270
Tyr Leu Asn Lys Thr Asn Phe Asn His Ser Val Phe Asp Val Pro Leu
        275                 280                 285
His Tyr Gln Phe His Ala Ala Ser Thr Gln Gly Gly Gly Tyr Asp Met
    290                 295                 300
Arg Lys Leu Leu Asn Gly Thr Val Val Ser Lys His Pro Leu Lys Ser
305                 310                 315                 320
Val Thr Phe Val Asp Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu
                325                 330                 335
Ser Thr Val Gln Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu
            340                 345                 350
Thr Arg Glu Ser Gly Tyr Pro Gln Val Phe Tyr Gly Asp Met Tyr Gly
        355                 360                 365
Thr Lys Gly Asp Ser Gln Arg Glu Ile Pro Ala Leu Lys His Lys Ile
    370                 375                 380
Glu Pro Ile Leu Lys Ala Arg Lys Gln Tyr Ala Tyr Gly Ala Gln His
385                 390                 395                 400
Asp Tyr Phe Asp His His Asp Ile Val Gly Trp Thr Arg Glu Gly Asp
                405                 410                 415
Ser Ser Val Ala Asn Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro
            420                 425                 430
Gly Gly Ala Lys Arg Met Tyr Val Gly Arg Gln Asn Ala Gly Glu Thr
        435                 440                 445
Trp His Asp Ile Thr Gly Asn Arg Ser Glu Pro Val Val Ile Asn Ser
    450                 455                 460
Glu Gly Trp Gly Glu Phe His Val Asn Gly Gly Ser Val Ser Ile Tyr
465                 470                 475                 480
Val Gln Arg
```

<210> 5
<211> 480
<212> PRT
<213> Bacillus amyloliqufaciens

<400> 5

```
Val Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Thr Pro Asn Asp
 1               5                  10                  15
Gly Gln His Trp Lys Arg Leu Gln Asn Asp Ala Glu His Leu Ser Asp
            20                  25                  30
Ile Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly Leu Ser
        35                  40                  45
Gln Ser Asp Asn Gly Tyr Gly Pro Tyr Asp Leu Tyr Asp Leu Gly Glu
    50                  55                  60
Phe Gln Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ser Glu
65                  70                  75                  80
Leu Gln Asp Ala Ile Gly Ser Leu His Ser Arg Asn Val Gln Val Tyr
                85                  90                  95
Gly Asp Val Val Leu Asn His Lys Ala Gly Ala Asp Ala Thr Glu Asp
            100                 105                 110
Val Thr Ala Val Glu Val Asn Pro Ala Asn Arg Asn Gln Glu Thr Ser
        115                 120                 125
Glu Glu Tyr Gln Ile Lys Ala Trp Thr Asp Phe Arg Phe Pro Gly Arg
    130                 135                 140
Gly Asn Thr Tyr Ser Asp Phe Lys Trp His Trp Tyr His Phe Asp Gly
145                 150                 155                 160
Ala Asp Trp Asp Glu Ser Arg Lys Ile Ser Arg Ile Phe Lys Phe Arg
                165                 170                 175
Gly Glu Gly Lys Ala Trp Asp Trp Glu Val Ser Ser Glu Asn Gly Asn
            180                 185                 190
Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Tyr Asp His Pro Asp Val
        195                 200                 205
Val Ala Glu Thr Lys Lys Trp Gly Ile Trp Tyr Ala Asn Glu Leu Ser
    210                 215                 220
Leu Asp Gly Phe Arg Ile Asp Ala Ala Lys His Ile Lys Phe Ser Phe
225                 230                 235                 240
Leu Arg Asp Trp Val Gln Ala Val Arg Gln Ala Thr Gly Lys Glu Met
                245                 250                 255
Phe Thr Val Ala Glu Tyr Trp Gln Asn Asn Ala Gly Lys Leu Glu Asn
            260                 265                 270
Tyr Leu Asn Lys Thr Ser Phe Asn Gln Ser Val Phe Asp Val Pro Leu
        275                 280                 285
His Phe Asn Leu Gln Ala Ala Ser Ser Gln Gly Gly Gly Tyr Asp Met
    290                 295                 300
Arg Arg Leu Leu Asp Gly Thr Val Val Ser Arg His Pro Glu Lys Ala
305                 310                 315                 320
Val Thr Phe Val Glu Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu
                325                 330                 335
Ser Thr Val Gln Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu
            340                 345                 350
Thr Arg Glu Ser Gly Tyr Pro Gln Val Phe Tyr Gly Asp Met Tyr Gly
        355                 360                 365
Thr Lys Gly Thr Ser Pro Lys Glu Ile Pro Ser Leu Lys Asp Asn Ile
    370                 375                 380
Glu Pro Ile Leu Lys Ala Arg Lys Glu Tyr Ala Tyr Gly Pro Gln His
385                 390                 395                 400
Asp Tyr Ile Asp His Pro Asp Val Ile Gly Trp Thr Arg Glu Gly Asp
                405                 410                 415
Ser Ser Ala Ala Lys Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro
            420                 425                 430
Gly Gly Ser Lys Arg Met Tyr Ala Gly Leu Lys Asn Ala Gly Glu Thr
        435                 440                 445
```

```
Trp Tyr Asp Ile Thr Gly Asn Arg Ser Asp Thr Val Lys Ile Gly Ser
    450                 455                 460
Asp Gly Trp Gly Glu Phe His Val Asn Asp Gly Ser Val Ser Ile Tyr
465                 470                 475                 480
```

<210> 6
<211> 485
<212> PRT
<213> Bacillus sp.

<400> 6

```
His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr
 1               5                  10                  15
Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Asn Ser Asp Ala Ser
            20                  25                  30
Asn Leu Lys Ser Lys Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Trp
        35                  40                  45
Lys Gly Ala Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
    50                  55                  60
Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
65                  70                  75                  80
Thr Arg Ser Gln Leu Gln Ala Ala Val Thr Ser Leu Lys Asn Asn Gly
                85                  90                  95
Ile Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
            100                 105                 110
Ala Thr Glu Met Val Arg Ala Val Glu Val Asn Pro Asn Asn Arg Asn
        115                 120                 125
Gln Glu Val Thr Gly Glu Tyr Thr Ile Glu Ala Trp Thr Arg Phe Asp
    130                 135                 140
Phe Pro Gly Arg Gly Asn Thr His Ser Ser Phe Lys Trp Arg Trp Tyr
145                 150                 155                 160
His Phe Asp Gly Val Asp Trp Asp Gln Ser Arg Arg Leu Asn Asn Arg
                165                 170                 175
Ile Tyr Lys Phe Arg Gly His Gly Lys Ala Trp Asp Trp Glu Val Asp
            180                 185                 190
Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Ile Asp Met
        195                 200                 205
Asp His Pro Glu Val Val Asn Glu Leu Arg Asn Trp Gly Val Trp Tyr
    210                 215                 220
Thr Asn Thr Leu Gly Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
225                 230                 235                 240
Ile Lys Tyr Ser Phe Thr Arg Asp Trp Ile Asn His Val Arg Ser Ala
                245                 250                 255
Thr Gly Lys Asn Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
            260                 265                 270
Gly Ala Ile Glu Asn Tyr Leu Gln Lys Thr Asn Trp Asn His Ser Val
        275                 280                 285
Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Lys Ser Gly
    290                 295                 300
Gly Asn Tyr Asp Met Arg Asn Ile Phe Asn Gly Thr Val Val Gln Arg
305                 310                 315                 320
His Pro Ser His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
                325                 330                 335
Glu Glu Ala Leu Glu Ser Phe Val Glu Glu Trp Phe Lys Pro Leu Ala
            340                 345                 350
Tyr Ala Leu Thr Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
        355                 360                 365
Gly Asp Tyr Tyr Gly Ile Pro Thr His Gly Val Pro Ala Met Arg Ser
    370                 375                 380
Lys Ile Asp Pro Ile Leu Glu Ala Arg Gln Lys Tyr Ala Tyr Gly Lys
385                 390                 395                 400
Gln Asn Asp Tyr Leu Asp His His Asn Ile Ile Gly Trp Thr Arg Glu
```

```
                405                 410                 415
Gly Asn Thr Ala His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
            420                 425                 430
Gly Ala Gly Gly Ser Lys Trp Met Phe Val Gly Arg Asn Lys Ala Gly
        435                 440                 445
Gln Val Trp Ser Asp Ile Thr Gly Asn Arg Thr Gly Thr Val Thr Ile
    450                 455                 460
Asn Ala Asp Gly Trp Gly Asn Phe Ser Val Asn Gly Gly Ser Val Ser
465                 470                 475                 480
Ile Trp Val Asn Lys
                485
```

<210> 7
<211> 485
<212> PRT
<213> Bacillus sp.

<400> 7

```
His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr
 1               5                  10                  15
Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Arg Asp Asp Ala Ala
            20                  25                  30
Asn Leu Lys Ser Lys Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Trp
        35                  40                  45
Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
    50                  55                  60
Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
65                  70                  75                  80
Thr Arg Asn Gln Leu Gln Ala Ala Val Thr Ser Leu Lys Asn Asn Gly
                85                  90                  95
Ile Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
            100                 105                 110
Gly Thr Glu Ile Val Asn Ala Val Glu Val Asn Arg Ser Asn Arg Asn
        115                 120                 125
Gln Glu Thr Ser Gly Glu Tyr Ala Ile Glu Ala Trp Thr Lys Phe Asp
    130                 135                 140
Phe Pro Gly Arg Gly Asn Asn His Ser Ser Phe Lys Trp Arg Trp Tyr
145                 150                 155                 160
His Phe Asp Gly Thr Asp Trp Asp Gln Ser Arg Gln Leu Gln Asn Lys
                165                 170                 175
Ile Tyr Lys Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Asp
            180                 185                 190
Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Met
        195                 200                 205
Asp His Pro Glu Val Ile His Glu Leu Arg Asn Trp Gly Val Trp Tyr
    210                 215                 220
Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
225                 230                 235                 240
Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Thr
                245                 250                 255
Thr Gly Lys Pro Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
            260                 265                 270
Gly Ala Ile Glu Asn Tyr Leu Asn Lys Thr Ser Trp Asn His Ser Val
        275                 280                 285
Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly
    290                 295                 300
Gly Tyr Tyr Asp Met Arg Asn Ile Leu Asn Gly Ser Val Val Gln Lys
305                 310                 315                 320
His Pro Thr His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
                325                 330                 335
Gly Glu Ala Leu Glu Ser Phe Val Gln Gln Trp Phe Lys Pro Leu Ala
            340                 345                 350
```

```
Tyr Ala Leu Val Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
        355                 360                 365
Gly Asp Tyr Tyr Gly Ile Pro Thr His Gly Val Pro Ala Met Lys Ser
    370                 375                 380
Lys Ile Asp Pro Leu Leu Gln Ala Arg Gln Thr Phe Ala Tyr Gly Thr
385                 390                 395                 400
Gln His Asp Tyr Phe Asp His His Asp Ile Ile Gly Trp Thr Arg Glu
                405                 410                 415
Gly Asn Ser Ser His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
            420                 425                 430
Gly Pro Gly Gly Asn Lys Trp Met Tyr Val Gly Lys Asn Lys Ala Gly
        435                 440                 445
Gln Val Trp Arg Asp Ile Thr Gly Asn Arg Thr Gly Thr Val Thr Ile
    450                 455                 460
Asn Ala Asp Gly Trp Gly Asn Phe Ser Val Asn Gly Gly Ser Val Ser
465                 470                 475                 480
Val Trp Val Lys Gln
                485
```

<210> 8
<211> 485
<212> PRT
<213> Bacillus sp.

<400> 8

```
His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp His
 1               5                  10                  15
Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Arg Asp Asp Ala Ser
            20                  25                  30
Asn Leu Arg Asn Arg Gly Ile Thr Ala Ile Trp Ile Pro Pro Ala Trp
        35                  40                  45
Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
    50                  55                  60
Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly
65                  70                  75                  80
Thr Arg Ser Gln Leu Glu Ser Ala Ile His Ala Leu Lys Asn Asn Gly
                85                  90                  95
Val Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
            100                 105                 110
Ala Thr Glu Asn Val Leu Ala Val Glu Val Asn Pro Asn Asn Arg Asn
        115                 120                 125
Gln Glu Ile Ser Gly Asp Tyr Thr Ile Glu Ala Trp Thr Lys Phe Asp
    130                 135                 140
Phe Pro Gly Arg Gly Asn Thr Tyr Ser Asp Phe Lys Trp Arg Trp Tyr
145                 150                 155                 160
His Phe Asp Gly Val Asp Trp Asp Gln Ser Arg Gln Phe Gln Asn Arg
                165                 170                 175
Ile Tyr Lys Phe Arg Gly Asp Gly Lys Ala Trp Asp Trp Glu Val Asp
            180                 185                 190
Ser Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Met
        195                 200                 205
Asp His Pro Glu Val Val Asn Glu Leu Arg Arg Trp Gly Glu Trp Tyr
    210                 215                 220
Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
225                 230                 235                 240
Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Ala
                245                 250                 255
Thr Gly Lys Glu Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
            260                 265                 270
Gly Ala Leu Glu Asn Tyr Leu Asn Lys Thr Asn Trp Asn His Ser Val
        275                 280                 285
Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly
```

```
    290                 295                 300
Gly Asn Tyr Asp Met Ala Lys Leu Leu Asn Gly Thr Val Val Gln Lys
305                 310                 315                 320
His Pro Met His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
                325                 330                 335
Gly Glu Ser Leu Glu Ser Phe Val Gln Glu Trp Phe Lys Pro Leu Ala
            340                 345                 350
Tyr Ala Leu Ile Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
        355                 360                 365
Gly Asp Tyr Tyr Gly Ile Pro Thr His Ser Val Pro Ala Met Lys Ala
    370                 375                 380
Lys Ile Asp Pro Ile Leu Glu Ala Arg Gln Asn Phe Ala Tyr Gly Thr
385                 390                 395                 400
Gln His Asp Tyr Phe Asp His His Asn Ile Ile Gly Trp Thr Arg Glu
                405                 410                 415
Gly Asn Thr Thr His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp
            420                 425                 430
Gly Pro Gly Gly Glu Lys Trp Met Tyr Val Gly Gln Asn Lys Ala Gly
        435                 440                 445
Gln Val Trp His Asp Ile Thr Gly Asn Lys Pro Gly Thr Val Thr Ile
    450                 455                 460
Asn Ala Asp Gly Trp Ala Asn Phe Ser Val Asn Gly Gly Ser Val Ser
465                 470                 475                 480
Ile Trp Val Lys Arg
                485
```

<210> 9
<211> 1455
<212> DNA
<213> Bacillus

<400> 9

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catcataatg gaacaaatgg tactatgatg caatatttcg aatggtattt gccaaatgac      60
gggaatcatt ggaacaggtt gagggatgac gcagctaact taaagagtaa agggataaca     120
gctgtatgga tcccacctgc atggaagggg acttcccaga atgatgtagg ttatggagcc     180
tatgatttat atgatcttgg agagtttaac cagaagggga cggttcgtac aaaatatgga     240
acacgcaacc agctacaggc tgcggtgacc tctttaaaaa ataacggcat tcaggtatat     300
ggtgatgtcg tcatgaatca taaaggtgga gcagatggta cggaaattgt aaatgcggta     360
gaagtgaatc ggagcaaccg aaaccaggaa acctcaggag agtatgcaat agaagcgtgg     420
acaaagtttg attttcctgg aagaggaaat aaccattcca gctttaagtg gcgctggtat     480
cattttgatg ggacagattg ggatcagtca cgccagcttc aaaacaaaat atataaattc     540
aggggaacag gcaaggcctg ggactgggaa gtcgatacag agaatggcaa ctatgactat     600
cttatgtatg cagacgtgga tatggatcac ccagaagtaa tacatgaact tagaaactgg     660
ggagtgtggt atacgaatac actgaacctt gatggattta gaatagatgc agtgaaacat     720
ataaaatata gctttacgag agattggctt acacatgtgc gtaacaccac aggtaaacca     780
atgtttgcag tggctgagtt ttggaaaaat gaccttggtg caattgaaaa ctatttgaat     840
aaaacaagtt ggaatcactc ggtgtttgat gttcctctcc actataattt gtacaatgca     900
tctaatagcg gtggttatta tgatatgaga aatattttaa atggttctgt ggtgcaaaaa     960
catccaacac atgccgttac ttttgttgat aaccatgatt ctcagcccgg ggaagcattg    1020
gaatcctttg ttcaacaatg gtttaaacca cttgcatatg cattggttct gacaagggaa    1080
caaggttatc cttccgtatt ttatggggat tactacggta tcccaaccca tggtgttccg    1140
gctatgaaat ctaaaataga ccctcttctg caggcacgtc aaacttttgc ctatggtacg    1200
cagcatgatt actttgatca tcatgatatt atcggttgga caagagaggg aaatagctcc    1260
catccaaatt caggccttgc caccattatg tcagatggtc caggtggtaa caaatggatg    1320
tatgtgggga aaaataaagc gggacaagtt tggagagata ttaccggaaa taggacaggc    1380
accgtcacaa ttaatgcaga cggatggggt aatttctctg ttaatggagg gtccgtttcg    1440
gtttgggtga agcaa                                                     1455
```

<210> 10
<211> 1455
<212> DNA
<213> Bacillus sp.

<400> 10
catcataatg ggacaaatgg gacgatgatg caatactttg aatggcactt gcctaatgat 60
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gctatttgga ttccgcctgc ctggaaaggg acttcgcaaa atgatgtggg gtatggagcc 180
tatgatcttt atgatttagg ggaatttaat caaaagggga cggttcgtac taagtatggg 240
acacgtagtc aattggagtc tgccatccat gctttaaaga ataatggcgt tcaagtttat 300
ggggatgtag tgatgaacca taaaggagga gctgatgcta cagaaaacgt tcttgctgtc 360
gaggtgaatc caaataaccg gaatcaagaa atatctgggg actacacaat tgaggcttgg 420
actaagtttg attttccagg gaggggtaat acatactcag actttaaatg gcgttggtat 480
catttcgatg gtgtagattg ggatcaatca cgacaattcc aaaatcgtat ctacaaattc 540
cgaggtgatg gtaaggcatg ggattgggaa gtagattcgg aaaatggaaa ttatgattat 600
ttaatgtatg cagatgtaga tatggatcat ccggaggtag taaatgagct tagaagatgg 660
ggagaatggt atacaaatac attaaatctt gatggattta ggatcgatgc ggtgaagcat 720
attaaatata gctttacacg tgattggttg acccatgtaa gaaacgcaac gggaaaagaa 780
atgtttgctg ttgctgaatt ttggaaaaat gatttaggtg ccttggagaa ctatttaaat 840
aaaacaaact ggaatcattc tgtctttgat gtccccctc attataatct ttataacgcg 900
tcaaatagtg gaggcaacta tgacatggca aaacttctta atggaacggt tgttcaaaag 960
catccaatgc atgccgtaac ttttgtggat aatcacgatt ctcaacctgg ggaatcatta 1020
gaatcatttg tacaagaatg gtttaagcca cttgcttatg cgcttatttt aacaagagaa 1080
caaggctatc cctctgtctt ctatggtgac tactatggaa ttccaacaca tagtgtccca 1140
gcaatgaaag ccaagattga tccaatctta gaggcgcgtc aaaatttttgc atatggaaca 1200
caacatgatt attttgacca tcataatata atcggatgga cacgtgaagg aaataccacg 1260
catcccaatt caggacttgc gactatcatg tcggatgggc caggggggaga gaaatggatg 1320
tacgtagggc aaaataaagc aggtcaagtt tggcatgaca taactggaaa taaaccagga 1380
acagttacga tcaatgcaga tggatgggct aatttttcag taaatggagg atctgtttcc 1440
atttgggtga aacga 1455

<210> 11
<211> 1548
<212> DNA
<213> Bacillus stearothermophilus

<400> 11
gccgcaccgt ttaacggcac catgatgcag tattttgaat ggtacttgcc ggatgatggc 60
acgttatgga ccaaagtggc caatgaagcc aacaacttat ccagccttgg catcaccgct 120
ctttggctgc cgcccgctta caaaggaaca agccgcagcg acgtagggta cggagtatac 180
gacttgtatg acctcggcga attcaatcaa aaagggaccg tccgcacaaa atacggaaca 240
aaagctcaat atcttcaagc cattcaagcc gcccacgccg ctggaatgca agtgtacgcc 300
gatgtcgtgt tcgaccataa aggcggcgct gacggcacgg aatgggtgga cgccgtcgaa 360
gtcaatccgt ccgaccgcaa ccaagaaatc tcgggcacct atcaaatcca agcatggacg 420
aaatttgatt ttcccgggcg gggcaacacc tactccagct ttaagtggcg ctggtaccat 480
tttgacggcg ttgattggga cgaaagccga aaattgagcc gcatttacaa attccgcggc 540
atcggcaaag cgtgggattg ggaagtagac acggaaaacg gaaactatga ctacttaatg 600
tatgccgacc ttgatatgga tcatcccgaa gtcgtgaccg agctgaaaaa ctgggggaaa 660
tggtatgtca acacaacgaa cattgatggg ttccggcttg atgccgtcaa gcatattaag 720
ttcagttttt ttcctgattg gttgtcgtat gtgcgttctc agactggcaa gccgctattt 780
accgtcgggg aatattggag ctatgacatc aacaagttgc acaattacat tacgaaaaca 840
gacggaacga tgtctttgtt tgatgccccg ttacacaaca aattttatac cgcttccaaa 900
tcaggggggcg catttgatat gcgcacgtta atgaccaata ctctcatgaa agatcaaccg 960
acattggccg tcaccttcgt tgataatcat gacaccgaac ccggccaagc gctgcagtca 1020
tgggtcgacc catggttcaa accgttggct tacgccttta ttctaactcg gcaggaagga 1080
tacccgtgcg tcttttatgg tgactattat ggcattccac aatataacat tccttcgctg 1140
aaaagcaaaa tcgatccgct cctcatcgcg cgcagggatt atgcttacgg aacgcaacat 1200
gattatcttg atcactccga catcatcggg tggacaaggg aaggggcac tgaaaaacca 1260
ggatccggac tggccgcact gatcaccgat gggccgggag gaagcaaatg gatgtacgtt 1320
ggcaaacaac acgctggaaa agtgttctat gaccttaccg gcaaccggag tgacaccgtc 1380
accatcaaca gtgatggatg gggggaattc aaagtcaatg gcggttcggt ttcggtttgg 1440
gttcctagaa aaacgaccgt ttctaccatc gctcggccga tcacaacccg accgtggact 1500
ggtgaattcg tccgttggac cgaaccacgg ttggtggcat ggccttga 1548

<210> 12

<211> 1920
<212> DNA
<213> Bacillus licheniformis

<220>
<221> CDS
<222> (421)...(1872)

<400> 12

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cggaagattg gaagtacaaa aataagcaaa agattgtcaa tcatgtcatg agccatgcgg     60
gagacggaaa aatcgtctta atgcacgata tttatgcaac gttcgcagat gctgctgaag    120
agattattaa aaagctgaaa gcaaaaggct atcaattggt aactgtatct cagcttgaag    180
aagtgaagaa gcagagaggc tattgaataa atgagtagaa gcgccatatc ggcgcttttc    240
ttttggaaga aaatataggg aaaatggtac ttgttaaaaa ttcggaatat ttatacaaca    300
tcatatgttt cacattgaaa ggggaggaga atcatgaaac aacaaaaacg gctttacgcc    360
cgattgctga cgctgttatt tgcgctcatc ttcttgctgc ctcattctgc agcagcggcg    420
gca aat ctt aat ggg acg ctg atg cag tat ttt gaa tgg tac atg ccc       468
Ala Asn Leu Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Met Pro
 1               5                  10                  15

aat gac ggc caa cat tgg agg cgt ttg caa aac gac tcg gca tat ttg      516
Asn Asp Gly Gln His Trp Arg Arg Leu Gln Asn Asp Ser Ala Tyr Leu
            20                  25                  30

gct gaa cac ggt att act gcc gtc tgg att ccc ccg gca tat aag gga      564
Ala Glu His Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly
        35                  40                  45

acg agc caa gcg gat gtg ggc tac ggt gct tac gac ctt tat gat tta      612
Thr Ser Gln Ala Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr Asp Leu
    50                  55                  60

ggg gag ttt cat caa aaa ggg acg gtt cgg aca aag tac ggc aca aaa      660
Gly Glu Phe His Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys
65                  70                  75                  80

gga gag ctg caa tct gcg atc aaa agt ctt cat tcc cgc gac att aac      708
Gly Glu Leu Gln Ser Ala Ile Lys Ser Leu His Ser Arg Asp Ile Asn
                85                  90                  95

gtt tac ggg gat gtg gtc atc aac cac aaa ggc ggc gct gat gcg acc      756
Val Tyr Gly Asp Val Val Ile Asn His Lys Gly Gly Ala Asp Ala Thr
            100                 105                 110

gaa gat gta acc gcg gtt gaa gtc gat ccc gct gac cgc aac cgc gta      804
Glu Asp Val Thr Ala Val Glu Val Asp Pro Ala Asp Arg Asn Arg Val
        115                 120                 125

att tca gga gaa cac cta att aaa gcc tgg aca cat ttt cat ttt ccg      852
Ile Ser Gly Glu His Leu Ile Lys Ala Trp Thr His Phe His Phe Pro
    130                 135                 140

ggg cgc ggc agc aca tac agc gat ttt aaa tgg cat tgg tac cat ttt      900
Gly Arg Gly Ser Thr Tyr Ser Asp Phe Lys Trp His Trp Tyr His Phe
145                 150                 155                 160

gac gga acc gat tgg gac gag tcc cga aag ctg aac cgc atc tat aag      948
Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn Arg Ile Tyr Lys
                165                 170                 175

ttt caa gga aag gct tgg gat tgg gaa gtt tcc aat gaa aac ggc aac      996
Phe Gln Gly Lys Ala Trp Asp Trp Glu Val Ser Asn Glu Asn Gly Asn
```

```
                180                 185                 190

tat gat tat ttg atg tat gcc gac atc gat tat gac cat cct gat gtc     1044
Tyr Asp Tyr Leu Met Tyr Ala Asp Ile Asp Tyr Asp His Pro Asp Val
        195                 200                 205

gca gca gaa att aag aga tgg ggc act tgg tat gcc aat gaa ctg caa     1092
Ala Ala Glu Ile Lys Arg Trp Gly Thr Trp Tyr Ala Asn Glu Leu Gln
    210                 215                 220

ttg gac ggt ttc cgt ctt gat gct gtc aaa cac att aaa ttt tct ttt     1140
Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Phe Ser Phe
225                 230                 235                 240

ttg cgg gat tgg gtt aat cat gtc agg gaa aaa acg ggg aag gaa atg     1188
Leu Arg Asp Trp Val Asn His Val Arg Glu Lys Thr Gly Lys Glu Met
                245                 250                 255

ttt acg gta gct gaa tat tgg cag aat gac ttg ggc gcg ctg gaa aac     1236
Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Leu Gly Ala Leu Glu Asn
            260                 265                 270

tat ttg aac aaa aca aat ttt aat cat tca gtg ttt gac gtg ccg ctt     1284
Tyr Leu Asn Lys Thr Asn Phe Asn His Ser Val Phe Asp Val Pro Leu
        275                 280                 285

cat tat cag ttc cat gct gca tcg aca cag gga ggc ggc tat gat atg     1332
His Tyr Gln Phe His Ala Ala Ser Thr Gln Gly Gly Gly Tyr Asp Met
    290                 295                 300

agg aaa ttg ctg aac ggt acg gtc gtt tcc aag cat ccg ttg aaa tcg     1380
Arg Lys Leu Leu Asn Gly Thr Val Val Ser Lys His Pro Leu Lys Ser
305                 310                 315                 320

gtt aca ttt gtc gat aac cat gat aca cag ccg ggg caa tcg ctt gag     1428
Val Thr Phe Val Asp Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu
                325                 330                 335

tcg act gtc caa aca tgg ttt aag ccg ctt gct tac gct ttt att ctc     1476
Ser Thr Val Gln Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu
            340                 345                 350

aca agg gaa tct gga tac cct cag gtt ttc tac ggg gat atg tac ggg     1524
Thr Arg Glu Ser Gly Tyr Pro Gln Val Phe Tyr Gly Asp Met Tyr Gly
        355                 360                 365

acg aaa gga gac tcc cag cgc gaa att cct gcc ttg aaa cac aaa att     1572
Thr Lys Gly Asp Ser Gln Arg Glu Ile Pro Ala Leu Lys His Lys Ile
    370                 375                 380

gaa ccg atc tta aaa gcg aga aaa cag tat gcg tac gga gca cag cat     1620
Glu Pro Ile Leu Lys Ala Arg Lys Gln Tyr Ala Tyr Gly Ala Gln His
385                 390                 395                 400

gat tat ttc gac cac cat gac att gtc ggc tgg aca agg gaa ggc gac     1668
Asp Tyr Phe Asp His His Asp Ile Val Gly Trp Thr Arg Glu Gly Asp
                405                 410                 415

agc tcg gtt gca aat tca ggt ttg gcg gca tta ata aca gac gga ccc     1716
Ser Ser Val Ala Asn Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro
            420                 425                 430
```

```
ggt ggg gca aag cga atg tat gtc ggc cgg caa aac gcc ggt gag aca     1764
Gly Gly Ala Lys Arg Met Tyr Val Gly Arg Gln Asn Ala Gly Glu Thr
        435                 440                 445

tgg cat gac att acc gga aac cgt tcg gag ccg gtt gtc atc aat tcg     1812
Trp His Asp Ile Thr Gly Asn Arg Ser Glu Pro Val Val Ile Asn Ser
    450                 455                 460

gaa ggc tgg gga gag ttt cac gta aac ggc ggg tcg gtt tca att tat     1860
Glu Gly Trp Gly Glu Phe His Val Asn Gly Gly Ser Val Ser Ile Tyr
465                 470                 475                 480

gtt caa aga tag aagagcagag aggacggatt tcctgaagga aatccgtttt         1912
Val Gln Arg  *

tttatttt                                                           1920
```

<210> 13
<211> 1455
<212> DNA
<213> Bacillus sp.

<400> 13

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gggaatcatt ggaacaggtt gagggatgac gcagctaact taaagagtaa agggataaca     120
gctgtatgga tcccacctgc atggaagggg acttcccaga atgatgtagg ttatggagcc     180
tatgatttat atgatcttgg agagtttaac cagaagggga cggttcgtac aaaatatgga     240
acacgcaacc agctacaggc tgcggtgacc tctttaaaaa ataacggcat tcaggtatat     300
ggtgatgtcg tcatgaatca taaaggtgga gcagatggta cggaaattgt aaatgcggta     360
gaagtgaatc ggagcaaccg aaaccaggaa acctcaggag agtatgcaat agaagcgtgg     420
acaaagtttg attttcctgg aagaggaaat aaccattcca gctttaagtg gcgctggtat     480
cattttgatg ggacagattg ggatcagtca cgccagcttc aaaacaaaat atataaattc     540
aggggaacag gcaaggcctg ggactgggaa gtcgatacag agaatggcaa ctatgactat     600
cttatgtatg cagacgtgga tatggatcac ccagaagtaa tacatgaact tagaaactgg     660
ggagtgtggt atacgaatac actgaacctt gatggattta gaatagatgc agtgaaacat     720
ataaaatata gctttacgag agattggctt acacatgtgc gtaacaccac aggtaaacca     780
atgtttgcag tggctgagtt ttggaaaaat gaccttggtg caattgaaaa ctatttgaat     840
aaaacaagtt ggaatcactc ggtgtttgat gttcctctcc actataattt gtacaatgca     900
tctaatagcg gtggttatta tgatatgaga aatattttaa atggttctgt ggtgcaaaaa     960
catccaacac atgccgttac ttttgttgat aaccatgatt ctcagcccgg ggaagcattg    1020
gaatcctttg ttcaacaatg gtttaaacca cttgcatatg cattggttct gacaagggaa    1080
caaggttatc cttccgtatt ttatggggat tactacggta tcccaaccca tggtgttccg    1140
gctatgaaat ctaaaataga ccctcttctg caggcacgtc aaacttttgc ctatggtacg    1200
cagcatgatt actttgatca tcatgatatt atcggttgga caagagaggg aaatagctcc    1260
catccaaatt caggccttgc caccattatg tcagatggtc caggtggtaa caaatggatg    1320
tatgtgggga aaaataaagc gggacaagtt tggagagata ttaccggaaa taggacaggc    1380
accgtcacaa ttaatgcaga cggatggggt aatttctctg ttaatggagg gtccgtttcg    1440
gtttgggtga agcaa                                                    1455
```

<210> 14
<211> 1455
<212> DNA
<213> Bacillus sp.

<400> 14

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catcataatg ggacaaatgg gacgatgatg caatactttg aatggcactt gcctaatgat      60
gggaatcact ggaatagatt aagagatgat gctagtaatc taagaaatag aggtataacc     120
gctatttgga ttccgcctgc ctggaaaggg acttcgcaaa atgatgtggg gtatggagcc     180
tatgatcttt atgatttagg ggaatttaat caaaagggga cggttcgtac taagtatggg     240
acacgtagtc aattggagtc tgccatccat gctttaaaga ataatggcgt tcaagtttat     300
ggggatgtag tgatgaacca taaaggagga gctgatgcta cagaaaacgt tcttgctgtc     360
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gaggtgaatc caaataaccg gaatcaagaa atatctgggg actacacaat tgaggcttgg 420
actaagtttg attttccagg gaggggtaat acatactcag actttaaatg gcgttggtat 480
catttcgatg gtgtagattg ggatcaatca cgacaattcc aaaatcgtat ctacaaattc 540
cgaggtgatg gtaaggcatg ggattgggaa gtagattcgg aaaatggaaa ttatgattat 600
ttaatgtatg cagatgtaga tatggatcat ccggaggtag taaatgagct tagaagatgg 660
ggagaatggt atacaaatac attaaatctt gatggattta ggatcgatgc ggtgaagcat 720
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tcaaatagtg gaggcaacta tgacatggca aaacttctta atggaacggt tgttcaaaag 960
catccaatgc atgccgtaac ttttgtggat aatcacgatt ctcaacctgg ggaatcatta 1020
gaatcatttg tacaagaatg gtttaagcca cttgcttatg cgcttatttt aacaagagaa 1080
caaggctatc cctctgtctt ctatggtgac tactatggaa ttccaacaca tagtgtccca 1140
gcaatgaaag ccaagattga tccaatctta gaggcgcgtc aaaattttgc atatggaaca 1200
caacatgatt attttgacca tcataatata atcggatgga cacgtgaagg aaataccacg 1260
catcccaatt caggacttgc gactatcatg tcggatgggc caggggaga gaaatggatg 1320
tacgtagggc aaaataaagc aggtcaagtt tggcatgaca taactggaaa taaaccagga 1380
acagttacga tcaatgcaga tggatgggct aatttttcag taaatggagg atctgtttcc 1440
atttgggtga aacga 1455

<210> 15
<211> 60
<212> DNA
<213> Artifiicial sequence

<220>
<223> primer

<400> 15
caaaatcgta tctacaaatt cmrkrsyarg dvktgggatt sggaagtaga ttcggaaaat 60

<210> 16
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 16
gaatttgtag atacgatttt g 21

<210> 17
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 17
cgattgctga cgctgttatt tgcg 24

<210> 18
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 18

cttgttccct tgtcagaacc aatg 24

<210> 19
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 19
gtcatagttg ccgaaatctg tatcgacttc 30

<210> 20
<211> 38
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 20
cccagtccca cgtacgtccc ctgaatttat atattttg 38

<210> 21
<211> 38
<212> DNA
<213> Artificial Sequence

<220>
<221> misc_feature
<222> (0)...(0)
<223> n on position 12 is 25% A, 25% C, 25% G, 25% T
Primer

<400> 21
cccagtccca gntctttccc ctgaatttat atattttg 38

<210> 22
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 22
gcgtggacaa agtttgattt tcctg 25

<210> 23
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 23
cctaatgatg ggaatcactg g 21

<210> 24
<211> 24

<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 24
gcattggatg cttttgaaca accg 24

<210> 25
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 25
cgcaaaatga tatcgggtat ggagcc 26

<210> 26
<211> 29
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 26
gtgatgaacc acswaggtgg agctgatgc 29

<210> 27
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 27
gatggtgtat ggrycaatca cgacaattcc 30

<210> 28
<211> 28
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 28
ggtgtatggg ataactcacg acaattcc 28

<210> 29
<211> 28
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 29
ggtgtatggg atctctcacg acaattcc 28

<210> 30
<211> 32
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 30
gggatcaatc acgaaatttc caaaatcgta tc 32

<210> 31
<211> 32
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 31
gggatcaatc acgactcttc caaaatcgta tc 32

<210> 32
<211> 34
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 32
ggaaattatg attatatcat gtatgcagat gtag 34

<210> 33
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 33
gctgaatttt ggtcgaatga tttaggtgcc 30

<210> 34
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 34
gctgaatttt ggtcgaatga tttaggtgcc 30

<210> 35
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atcagacagg gtatttttta tgctgtccag actgtccgct gtgtaaaaat aaggaataaa    180
ggggggttgt tattatttta ctgatatgta aaatataatt tgtataagaa aatgagaggg    240
agaggaaaca tgattcaaaa acgaaagcgg acagtttcgt tcagacttgt gcttatgtgc    300
acgctgttat ttgtcagttt gccgattaca aaaacatcag cc gta aat ggc acg       354
                                              Val Asn Gly Thr
                                               1

ctg atg cag tat ttt gaa tgg tat acg ccg aac gac ggc cag cat tgg      402
Leu Met Gln Tyr Phe Glu Trp Tyr Thr Pro Asn Asp Gly Gln His Trp
 5                  10                  15                  20

aaa cga ttg cag aat gat gcg gaa cat tta tcg gat atc gga atc act      450
Lys Arg Leu Gln Asn Asp Ala Glu His Leu Ser Asp Ile Gly Ile Thr
                25                  30                  35

gcc gtc tgg att cct ccc gca tac aaa gga ttg agc caa tcc gat aac      498
Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly Leu Ser Gln Ser Asp Asn
            40                  45                  50

gga tac gga cct tat gat ttg tat gat tta gga gaa ttc cag caa aaa      546
Gly Tyr Gly Pro Tyr Asp Leu Tyr Asp Leu Gly Glu Phe Gln Gln Lys
        55                  60                  65

ggg acg gtc aga acg aaa tac ggc aca aaa tca gag ctt caa gat gcg      594
Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ser Glu Leu Gln Asp Ala
    70                  75                  80

atc ggc tca ctg cat tcc cgg aac gtc caa gta tac gga gat gtg gtt      642
Ile Gly Ser Leu His Ser Arg Asn Val Gln Val Tyr Gly Asp Val Val
 85                  90                  95                  100

ttg aat cat aag gct ggt gct gat gca aca gaa gat gta act gcc gtc      690
Leu Asn His Lys Ala Gly Ala Asp Ala Thr Glu Asp Val Thr Ala Val
                105                 110                 115

gaa gtc aat ccg gcc aat aga aat cag gaa act tcg gag gaa tat caa      738
Glu Val Asn Pro Ala Asn Arg Asn Gln Glu Thr Ser Glu Glu Tyr Gln
            120                 125                 130

atc aaa gcg tgg acg gat ttt cgt ttt ccg ggc cgt gga aac acg tac      786
Ile Lys Ala Trp Thr Asp Phe Arg Phe Pro Gly Arg Gly Asn Thr Tyr
        135                 140                 145

agt gat ttt aaa tgg cat tgg tat cat ttc gac gga gcg gac tgg gat      834
Ser Asp Phe Lys Trp His Trp Tyr His Phe Asp Gly Ala Asp Trp Asp
    150                 155                 160

gaa tcc cgg aag atc agc cgc atc ttt aag ttt cgt ggg gaa gga aaa      882
Glu Ser Arg Lys Ile Ser Arg Ile Phe Lys Phe Arg Gly Glu Gly Lys
165                 170                 175                 180

gcg tgg gat tgg gaa gta tca agt gaa aac ggc aac tat gac tat tta      930
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Ala Trp Asp Trp Glu Val Ser Ser Glu Asn Gly Asn Tyr Asp Tyr Leu
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atg tat gct gat gtt gac tac gac cac cct gat gtc gtg gca gag aca      978
Met Tyr Ala Asp Val Asp Tyr Asp His Pro Asp Val Val Ala Glu Thr
            200                 205                 210

aaa aaa tgg ggt atc tgg tat gcg aat gaa ctg tca tta gac ggc ttc     1026
Lys Lys Trp Gly Ile Trp Tyr Ala Asn Glu Leu Ser Leu Asp Gly Phe
        215                 220                 225

cgt att gat gcc gcc aaa cat att aaa ttt tca ttt ctg cgt gat tgg     1074
Arg Ile Asp Ala Ala Lys His Ile Lys Phe Ser Phe Leu Arg Asp Trp
    230                 235                 240

gtt cag gcg gtc aga cag gcg acg gga aaa gaa atg ttt acg gtt gcg     1122
Val Gln Ala Val Arg Gln Ala Thr Gly Lys Glu Met Phe Thr Val Ala
245                 250                 255                 260

gag tat tgg cag aat aat gcc ggg aaa ctc gaa aac tac ttg aat aaa     1170
Glu Tyr Trp Gln Asn Asn Ala Gly Lys Leu Glu Asn Tyr Leu Asn Lys
                265                 270                 275

aca agc ttt aat caa tcc gtg ttt gat gtt ccg ctt cat ttc aat tta     1218
Thr Ser Phe Asn Gln Ser Val Phe Asp Val Pro Leu His Phe Asn Leu
            280                 285                 290

cag gcg gct tcc tca caa gga ggc gga tat gat atg agg cgt ttg ctg     1266
Gln Ala Ala Ser Ser Gln Gly Gly Gly Tyr Asp Met Arg Arg Leu Leu
        295                 300                 305

gac ggt acc gtt gtg tcc agg cat ccg gaa aag gcg gtt aca ttt gtt     1314
Asp Gly Thr Val Val Ser Arg His Pro Glu Lys Ala Val Thr Phe Val
    310                 315                 320

gaa aat cat gac aca cag ccg gga cag tca ttg gaa tcg aca gtc caa     1362
Glu Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu Ser Thr Val Gln
325                 330                 335                 340

act tgg ttt aaa ccg ctt gca tac gcc ttt att ttg aca aga gaa tcc     1410
Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Thr Arg Glu Ser
                345                 350                 355

ggt tat cct cag gtg ttc tat ggg gat atg tac ggg aca aaa ggg aca     1458
Gly Tyr Pro Gln Val Phe Tyr Gly Asp Met Tyr Gly Thr Lys Gly Thr
            360                 365                 370

tcg cca aag gaa att ccc tca ctg aaa gat aat ata gag ccg att tta     1506
Ser Pro Lys Glu Ile Pro Ser Leu Lys Asp Asn Ile Glu Pro Ile Leu
        375                 380                 385

aaa gcg cgt aag gag tac gca tac ggg ccc cag cac gat tat att gac     1554
Lys Ala Arg Lys Glu Tyr Ala Tyr Gly Pro Gln His Asp Tyr Ile Asp
    390                 395                 400

cac ccg gat gtg atc gga tgg acg agg gaa ggt gac agc tcc gcc gcc     1602
His Pro Asp Val Ile Gly Trp Thr Arg Glu Gly Asp Ser Ser Ala Ala
405                 410                 415                 420

aaa tca ggt ttg gcc gct tta atc acg gac gga ccc ggc gga tca aag     1650
Lys Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro Gly Gly Ser Lys
                425                 430                 435
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cgg atg tat gcc ggc ctg aaa aat gcc ggc gag aca tgg tat gac ata     1698
Arg Met Tyr Ala Gly Leu Lys Asn Ala Gly Glu Thr Trp Tyr Asp Ile
            440                 445                 450

acg ggc aac cgt tca gat act gta aaa atc gga tct gac ggc tgg gga     1746
Thr Gly Asn Arg Ser Asp Thr Val Lys Ile Gly Ser Asp Gly Trp Gly
        455                 460                 465

gag ttt cat gta aac gat ggg tcc gtc tcc att tat gtt cag aaa taa     1794
Glu Phe His Val Asn Asp Gly Ser Val Ser Ile Tyr Val Gln Lys
    470                 475                 480

ggtaataaaa aaacacctcc aagctgagtg cgggtatcag cttggaggtg cgtttatttt   1854
ttcagccgta tgacaaggtc ggcatcaggt gtgacaaata cggtatgctg gctgtcatag   1914
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